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AFRL names 2003 fellow nominees

by Jill Bohn, AFRL Public Affairs

WRIGHT-PATTERSON AIR FORCE BASE, Ohio —The Air Force Research Laboratory has named seven of its top scientists and engineers to the status of AFRL Fellow.

Fellows for 2003 are Wayne Bonser, Information Directorate, Rome Research Site; Dr. Gail Brown, Materials and Manufacturing Directorate, Wright-Patterson Air Force Base; Dr. Raymond Gordnier, Air Vehicles Directorate, Wright-Patterson Air Force Base; Dr. Kirk Hackett, Directed Energy Directorate, Kirtland Air Force Base; William McQuay, Information Directorate, Wright-Patterson Air Force Base; Dr. Robert Pugh, Space Vehicles Directorate, Kirtland Air Force Base; and Dr. Jeffrey Zabinski, Materials and Manufacturing Directorate, Wright-Patterson Air Force Base.

Bonser has been selected, in part, for his role as a national leader in the development and application of software radio technology with countless transitions and transfers. His insight that growth in hardware complexity was hindering rapid progress in new waveforms was used to shift development toward the innovative idea of software-defined radios.

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Pictured from top left Wayne Bonser, Gail Brown Raymond Gordnier; second row, Kirk Hackett, William McQuay, Robert Pugh; third row, Jeffrey Zabiniski

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http://extra.afrl.af.mil/news/index.htm

AFRL vice commander takes the reigns

by 2nd Lt. J. Elaine Hunnicutt, AFRL Public Affairs

Col. David Walker

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Col. David Walker took over the Air Force Research Laboratory vice commander position July 8.

He will play a key role in directing the Air Force's $3 billion science and technology budget, which includes $1.3 billion from laboratory customers.

Walker, the son of an Air Force pilot, has flown more than 2,600 hours, in 65 types of aircraft, as a weapon systems officer during his Air Force career.

He joins AFRL after commanding the 412th Operation Groups, Edwards Air Force Base, Calif., where he led the developmental flight tests of the F/A-22, YAL-1, RQ-4A, X-45, X-35 and sustainment of the Air Force's fighters, bombers and transport aircraft.

A father of four, he hopes that his operational and test background will provide AFRL with some useful insight and credibility with the users while the laboratory strives to meet the warfighter's needs.

Walker intends to focus on two main goals as the vice commander. First, he wants to see AFRL adopt an enterprise approach and function as a corporate operation, especially in regard to AFRL's long-range planning. Second, he will continue to mentor the military side of the house and strive for promotions and awards for those who deserve recognition.

"I will allow folks to do their job," Walker said. "I will provide them the resources to do that job and the vision for where we are headed, while minimizing unnecessary interference."

Walker was commissioned in 1979, through the Reserve Officer Training Corps at the University of Texas, Austin, where he earned both his bachelor's and master's degrees in aerospace engineering. He also holds a doctorate degree in aeronautical engineering from the Air Force Institute of Technology. @

Coming next month

Gen. Nielsen speaks at business conference

AFRL recognizes annual corporate awards winners

AFRL supports Columbia accident investigation

Spray cooling technology promises better capability for high power electronics

by Michael Kelly, Propulsion Directorate

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — A small team from the Air Force Research Laboratory's Propulsion Directorate is eager to supply future capabilities with studies they're conducting. A small team from the Air Force Research Laboratory's Propulsion Directorate is eager to supply those future capabilities with studies they're conducting. The team is tackling the ever-increasing problem of space thermal management — the cooling of powerful electronic devices used in space vehicles like satellites, the space shuttle and the International Space Station.

Led by Dr. Kirk Yerkes, an expert in fluid mechanics engineering, the team's challenge is to get rid of heat generated by more and more powerful semiconductors and electronic devices filling the bellies of these space-based beasts.

Most currently generate very low heat fluxes and can be removed by the flow of air over the hot device — but as performance of small electronic devices steadily increases, heat removal from these devices for space use is approaching critical limits, according to many space industry and NASA experts. Computer chips just an eighth of an inch square will soon emit as much heat as a 100-watt light bulb, according to NASA officials.

To combat this problem, scientists and engineers have developed "spray cooling" technologies using liquids such as water or ammonia to remove high heat fluxes from the hot surfaces of aircraft electronic components, Yerkes said.

The concept is similar to humans sweating, or evaporating moisture to cool the body, he said. However, unlike humans, electronic packages don't sweat and need a little help to cool down, which is where the "spray" comes in. Coolants are sprayed onto electronic packages and circuit boards, where they heat up by conduction and evaporate, providing life-saving cooling.

Yerkes, who helped research and develop existing "spray cooling" systems for electronic components in military aircraft, hopes to extend this proven technology into the world of microgravity. He and his team are in the process of building the hardware for a series of tests co-sponsored with NASA on the famous "Vomit Comet," a KC-135A that simulates microgravity — or weightlessness — conditions like those in space.

The experimental hardware buildup is nearing completion and Yerkes hopes to fly his spray chamber sometime this fall from the NASA Glenn Research Center in Cleveland, Ohio. He and his team are already Air Force and NASA flight qualified and ready to endure as many as 160 parabolas — flight maneuvers in the KC-135A to simulate weightlessness on four research flights over the course of a week.

In fact, they recently flew for the first time aboard NASA's KC-135A micro gravity test bed with a boiling experiment supported by the University of Maryland and NASA. AFRL researchers observed NASA's flight test process and became acclimated to conducting experiments in a micro- and high-g environment during these first flights.

"Our whole focus is to take spray cooling technology into the space environment because it represents a new capability for cooling certain technologies like lasers for surveillance or diagnostics for satellite instrumentation," Yerkes said. "There's also a need to cool military airborne and spaceborne platforms for directed energy weapons along with any number of systems that generate what we call high heat flux," he explained.

His biggest challenge will be demonstrating and identifying the spray cooling properties in a microgravity environment. It's a new frontier for the researcher with specialized background in heat mass transfer.

"The thermo physics of how these sprays work, or even if they'll work at all in this type of environment aren't known," Yerkes said. "The whole idea is to take away enough heat [from electronic components] that it makes a difference. @

Leahy takes over as commander of Det 1/Wright-Site

by 2nd Lt. J. Elaine Hunnicutt, AFRL Public Affairs

Col. Michael Leahy

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Col. Michael Leahy, Air Force Research Laboratory Detachment 1 commander, took command July 18, at Kenny Hall in the Air Force Institute of Technology.

Maj. Gen. Paul D. Nielsen, AFRL commander, presided over the ceremony.

"It is my privilege and honor to have the responsibility to command some of the finest knowledge warriors in the world," Leahy said.

The Detachment 1/Wright Research Site commander is responsible for taking care of the military personnel within AFRL, ensuring order and discipline. Along with the responsibilities of the Detachment 1 commander position, Leahy is also the Materiel Group Director of the Air Vehicles Directorate.

Leahy was commissioned in 1980, after earning his bachelor's degree in electrical engineering from Stevens Institute of Technology, Hoboken, N.J. He also holds a master's degree in electrical engineering from the University of New Mexico, Albuquerque, N.M., and a doctorate in electrical engineering from Rensselaer Polytechnic Institute, Troy, N.Y.

This is his third tour with AFRL. Leahy also served as an associate professor at AFIT, led the Air Force Material Command Robotics and Automation Center of Excellence, and served as the joint Defense Advanced Research Projects Agency/ U.S. Air Force Unmanned Combat Air Vehicle program director.

Col. Thomas Thacker, former AFRL Detachment 1 commander, relinquished command after serving one year in the position.

Thacker will continue his career at Wright-Patterson Air Force Base in the Aeronautical Systems Center, where he will work acquisitions in the C4ISR (Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance) field. @

Liquid oxygen turbopump testing deemed successful

by Ranney Adams, Propulsion Directorate

EDWARDS AIR FORCE BASE, Calif. — The Integrated Powerhead Demonstration (IPD) program completed a series of tests on its liquid oxygen turbopump components in early June 2003. It is the first American designed and fabricated oxygen-rich turbine driven pump. The series finished with the most challenging hot-fire test that demonstrated a steady-state run of 95% power.

Helping to train the next generation of rocket propulsion engineers, IPD technology development will provide the world's first hydrogen fueled rocket engine with oxygen-rich staged combustion. IPD is the only hydrogen boost rocket engine development program in existence today. It is also a cornerstone of NASA's Next Generation Launch Technology (NGLT) Program. The program provides the technology advances needed to overcome two major technical problems, turbine life and bearing wear. A key innovation in the high performance turbomachinery is the hydrostatic bearings that fully support the rotors of both the fuel and oxidizer pumps.

The joint Air Force and NASA IPD rocket engine component testing is currently being conducted at NASA's Stennis Space Center. The IPD program is part of a national program known as the Integrated High Payoff Rocket Propulsion Technology Program (IHPRPT) involving all DoD services, NASA, and American rocket industry partners. IHPRPT's intent is to double the performance and capabilities of rocket propulsion systems over the 1993 state-of-the-art, and to decrease the costs of access-to-space for commercial and military customers.

The $130M IPD engineering program for the 250,000 pound thrust class engine involves a team composed of engineers and managers from Air Force Research Laboratory's Propulsion Directorate, the NASA Marshall Space Flight Center, the NASA Stennis Space Center, Boeing-Rocketdyne, and GenCorp-Aerojet. @

New power technologies clear path to tactical directed energy weapons

by Michael Kelly, Propulsion Directorate

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Air Force Research Laboratory's Propulsion Directorate experts are helping power the American military structure as it transforms. Through their work in advanced electrical power and thermal management technologies, Propulsion Directorate experts are developing technologies to power concepts like high-power laser weapons on fighter aircraft, electronics-attacking microwaves and non-lethal technology that uses electromagnetic energy to stop an advancing adversary.

According to Rick Fingers, deputy for technology in the directorate's power division, recent advancements have been made in several areas addressing the challenges of supporting these futuristic weapons. The directorate's work is an outgrowth of the "more electric aircraft" program, which began as a thrust to develop electrical power technologies that replace aircraft hydraulic systems.

"One of the future's significant transformational technologies is adding directed energy weapons to the warfighter's arsenal," Fingers said. "The whole fervor for directed energy has blossomed as a result of power technologies and we're excited about our work in the directorate cutting that path into the future."

Directorate scientists and engineers have been on the ground floor of this enterprise, keeping a keen eye on where to focus their efforts. Developing a new class of higher operating temperature electrical components such as switches and capacitors along with super-conductivity and thermal management technologies was high on their list. All have shown tremendous progress, he said.

Researchers involved in developmental testing diamond-like Carbon Capacitors say their progress is the most significant in decades.

"Our team of scientists and engineers has enabled the production of capacitors with improved energy density and temperature capabilities that are more than two times better than today's state-of-the-art capacitors," said Sandra Fries-Carr, manager for the DLC capacitor program in the electrical technology and plasma physics branch.

Capacitors, which store an electrical charge, are critical components in nearly every military and commercial high performance system, she said. The improvements are crucial for airborne applications of directed energy weapons because they offer considerable savings in system weight, improved electrical performance and can withstand the types of high temperatures generated by the power systems feeding the electrically-driven weapons.

Another key enabling technology needed to develop Air Force directed energy weapons is a high temperature superconducting wire dubbed YBCO, for its molecular configuration of Yttrium, Barium and Copper Oxide.

The YBCO conductor is the next generation high temperature superconducting wire necessary for developing directed energy weapons, said Dr. Paul Barnes, a senior physicist and propulsion directorate superconductivity team leader.

"The need for compact, lightweight, high power generators and magnets is critical to quite a few defense applications," said Barnes. "A newer superconductor was needed that could operate at higher cryogenic temperatures to reduce the cooling requirement."

According to Barnes, by using YBCO conductor technology, high speed and high temperature superconducting generators can produce megawatts of electrical power while weighing up to 80 percent less than traditional iron-core generators. These size and weight reductions enable high power dependent weapon systems on air or mobile platforms, he said, opening the door to airborne applications such as directed energy weapons.

Electrical DEWs, which include the solid-state, high-energy laser and most high-power microwave sources, emit radiation energized by onboard electrical power.

"In fact, we plan to generate sufficient electrical power for the airborne DEW design concept by coupling a rotating electrical generator to the aircraft turbine engine," explained Scott Rubertus, deputy chief of the power division. @

DE Directorate establishes new beam control division

by Deb Mercurio, Directed Energy Directorate

KIRTLAND AIR FORCE BASE, N.M. — Establishing a Beam Control Division at the Air Force Research Laboratory's Directed Energy Directorate, announced by Air Force officials Thursday, July 24, will combine a division with a branch to focus on beam control efforts.

The work of the new division will focus on compensating for optical disturbances in the atmosphere in regard to imaging and laser propagation.

Headed by Lt. Col. Mark C. Crews, the division will combine the Starfire Optical Range Division with the Airborne Laser Technologies Branch to form the new division of approximately 65 military and civilian personnel.

"Combining beam control expertise and talents into a cohesive group, allows the organization of a technical program synergy for New Mexico optical sites, such as the Starfire Optical Range and North Oscura Peak," Crews said.

Starfire Optical Range and North Oscura Peak are two of the nation's premier optical ranges for atmospheric compensation and control of laser beams. These optical ranges are used for laser weapons development, earth to space laser propagation research, high-resolution satellite imaging, atmospheric turbulence research, and adaptive optics technology development.

Starfire Optical Range is located on a hilltop in the southeastern portion of Kirtland Air Force Base, N.M., and its primary mission is to develop optical sensing, imaging and propagation technologies to support Air Force aerospace missions.

North Oscura Peak is a site in the northern portion of the U.S. Army's White Sands Missile Range, N.M., and is designed to assemble and evaluate advanced sensor tracking and atmospheric compensation systems. A main goal is to improve the Air Force's ability to track missiles and then efficiently transmit laser energy through the atmosphere to destroy those missiles.

The mission of the new division is to develop, demonstrate and transition advanced beam control system technologies to provide high-performance, operational capabilities in beam control for laser applications.

Crews received a bachelor's degree from the U.S. Air Force Academy in 1982 and a master's degree from Massachusetts Institute of Technology in 1987, both in electrical engineering. He received a doctorate in electrical engineering from the University of Oxford, England in 1992. The new division chief is a native of Oklahoma City. @

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His insight that growth in hardware complexity was hindering rapid progress in new waveforms was used to shift development toward the innovative idea of software-defined radios.

Brown has been recognized for cutting edge research on superlattice materials for the next generation of infrared sensing. Her research has resulted in significant advancements in the fundamental physics, design parameters, and growth processes for type-II superlattice materials.

Gordnier was selected in recognition of his exceptional and sustained scientific contributions to the field of multidisciplinary computational sciences. His specific areas of expertise include the simulation of unsteady aerodynamics and fluid-structure interactions, critical elements in the understanding of air vehicle containment and performance.

Hackett has been recognized for his significant technical contributions and visionary technical leadership in the areas of high power microwaves and non-lethal weapons development. His research has been crucial to the development of Active Denial Technology.

McQuay was chosen for producing significant advancements in modeling and simulation technologies and collaborative sciences. His advanced simulation capabilities and analyses have led to the discovery of overlapping enemy emitter parameters, resulting in misidentification of threats, and thereby creating new requirements for receiver/possessor design specifications for the F-16 and B-2, and many others.

Pugh's contributions to AFRL have made a major impact on the nation's defense by providing radiation hardened space electronics to ensure robust operations, protection of space capabilities, and effective aerospace persistence in a hostile space environment.

Zabinski was honored for opening new research areas, such as the creation of Tribology in Extreme Environments and Microelectromecanical Systems Nanotribology research programs. His understanding of the fundamentals of tribology and thin film deposition has led to the discovery of new materials and processes that have revolutionized friction and wear technology.

"It's with great pleasure that I announce our newest fellows. These seven men and women have shown great leadership and creativity in support of our nation's air and space force," said AFRL Commander Maj. Gen. Paul D. Nielsen. "Through their innovation and drive, they are keeping America's Air Force the best in the world. I am extremely proud to have them as part of the AFRL team and to be able to recognize their productive and innovative careers by their selection as AFRL Fellows."

The selection committee considers both military and civilian scientists and engineers. To be eligible, participants must be assigned to AFRL for the past three consecutive years and have at least seven years of federal service.

The AFRL Fellows program is designed to recognize and reward the laboratory's most outstanding in-house scientists and engineers for their accomplishments and technical excellence.

This year's fellows will be honored Sept. 17 at the Ervin J. Nutter Center, Dayton. @

Net Index

Due to the number of submissions we receive, some sections of *news@afrl* are available exclusively on-line. The on-line version of the newsletter allows users to view the AFRL corporate calendar, news releases generated by AFRL headquarters, operating instructions, L@b L@urels and Roundups sections.

The L@b L@urels section of the electronic newsletter is dedicated to members of Air Force Research Laboratory who receive awards and honors. The Roundups section of the electronic newsletter keeps Air Force Research laboratory employees informed about contracts AFRL has awarded. Below is an index of articles one can find in each of these on-line sections.

L@b L@urels

Roundups

- **AFRL presents students with Century of Flight Awards**
- **PR's Hojnacki honored for accomplishments**
- **Chief Scientist, colleagues honored with Pioneer Award**
- **Rome awards SBIR contract to LPA Systems, Rochester**
- **AFRL Rome awards two contracts to Cymphony Inc.**
- **DE Directorate awards $23.3M research contract**

To view the full text of these and other articles visit the *news@afrl* page on the Internet at http://extra.afrl.af.mil/news/index.htm.
To submit L@b L@urels or Roundups from your directorate, send a query to AFRL Public Affairs at:

Jill.Bohn@afrl.af.mil

For more on these stories see news@afrl
http://extra.afrl.af.mil/news/index.htm

Marine officer takes oath

ROME, N.Y. — Col. Reid S. Lerum, chief of Contracting at the AFRL Rome Research Site, administers the commissioning oath to Marine 2nd Lt. Richard M. Arbogast. A May graduate of St. John Fisher College in Rochester, the lieutenant is the son of George E. Arbogast, a technical writer in the AFRL Information Directorate contracting division, and his wife, Karen. Arbogast will report to Quantico Marine Corps Base, Va., in September for training as an aviator. (Air Force photo by Michael Beaudette)